

Light budget assuming light loss in the fibers

The efficiency of TDA (Tile detector assembly) has recently been measured, and corresponding light yield was estimated. The measurements have been performed with relatively short fibers (only WSF) which collect the light from the tile and deliver it to the PMT. In the real design there will be up to 1.5 meters long fiber bundles to deliver the light from the farrest (in the middle of the top ACD surface) tiles to the PMT location. Two cases are considered in this memo – the resulting efficiency if no clear fibers are used and light is delivered to PMT by only WSF (1.5 meters long, 40% of the light loss), and with the use of fiber-to-fiber connectors and clear fibers to deliver the light to PMT (much more transparent fibers, the light loss is ~ 15%)

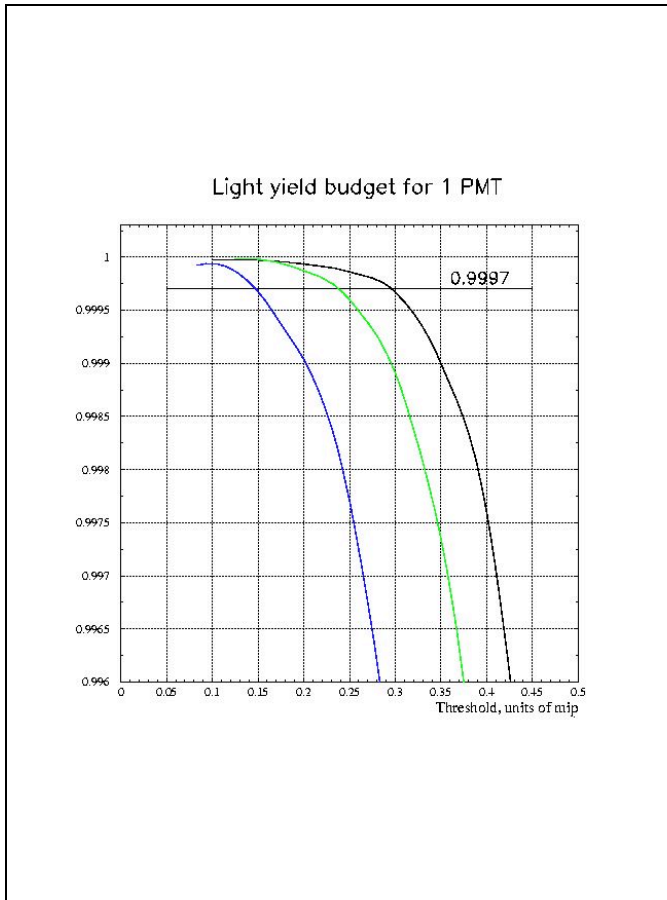


Fig.1. Light budget for 1 PMT.

Black line – measured efficiency (corresponds to 19 p.e.)
 Green line – efficiency assuming 15% light loss (16 p.e.)
 in the fiber connector and clear fibers
 Blue line – efficiency assuming 40% light loss (12 p.e.) in
 1.5 meters WSF

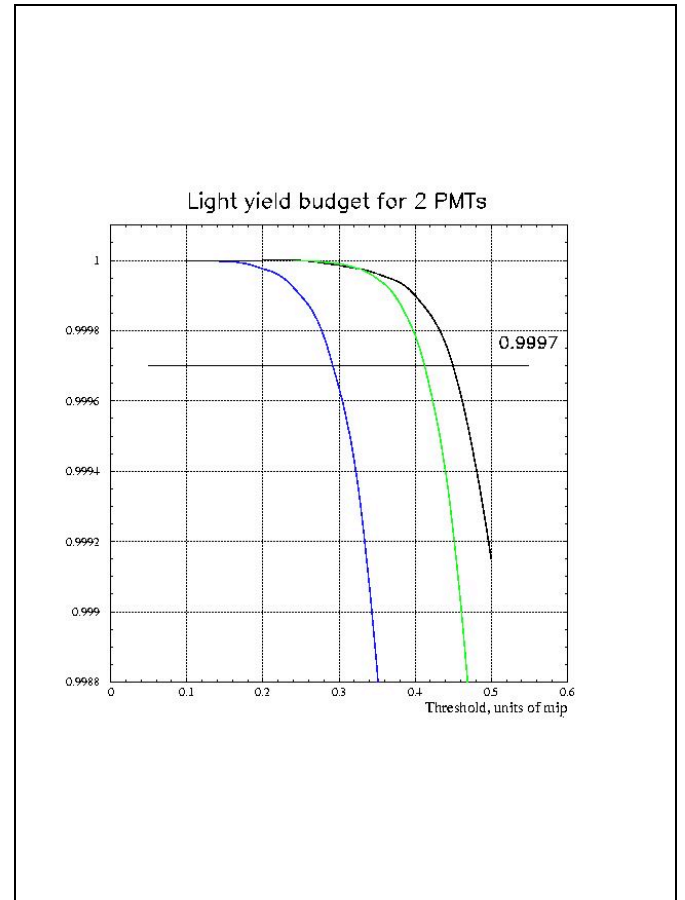


Fig.2. Light budget for 2 PMTs.

Black line – measured efficiency
 Green line – efficiency assuming 15% light loss
 Blue line – efficiency assuming 40% of the light loss

Conclusions. Assuming the ACD threshold to be 0.3 of the MIP, the efficiency of ACD can be obtained from shown figures. It is seen that there will be very significant efficiency degradation if we do not use clear fibers. Even running both PMTs, the required efficiency may not be achieved with 0.3 MIP threshold if the light is transmitted only by WSF. Running one PMT will not provide level of required efficiency (0.9997) even with the use of clear fibers. The efficiency can be increased by lowering the thresholds, but it will increase the self-veto caused by backplash, and also will reduce signal-to-noise ratio.